ENGINEERING ANALYSIS

PROJECT DESCRIPTION

On December 23, 2019, the Department received an application from Grooms Aluminum Processing (Grooms), for a new rotary melting furnace; Grooms submitted the signature for the application on February 21, 2020. The new furnace will have an increased capacity of 25 tons per melt, four times larger than the existing furnace. Grooms currently operates a rotary furnace with a capacity of 6.25 tons per melt, permitted by Synthetic Minor Operating Permit ("SMOP") 410-0041-X001.

The current SMOP 410-0041-X001 also allows for the operation of a Saturn shear shredder, though that unit is out of service. Grooms states in the application that emissions are controlled by wet suppression. However, SMOP 410-0041-X001 does not address control of air emissions from the shredder.

The application also serves as an update to Grooms' November 20, 2018 application for the new crushing system; the Department issued Air Permit 410-0041-X002 for the crushing system on March 16, 2020.

SMOP 410-0041-X001 will be voided, and SMOP 410-0041-X003 will be issued for the larger furnace with its increased emissions and particulate limit. Air Permit 410-0041-X002 will also be reissued as SMOP 410-0041-X002 to include new particulate matter limits on the crushing & screening operations. The shear shredder will be carried over into SMOP 410-0041-X002 rather than -X003, and its wet suppression system will be addressed.

PROCESS DESCRIPTION

Scrap feedstock, depending on the processing needed, will be conveyed through scrap shredder when returned to service then the proposed crushing mill and screens if not directly charged to the furnace. The 25-ton capacity rotary furnace, heated by one 20 MMBtu/hr natural gas burner, will melt aluminum scrap with flux; the estimated 6.25 tons per hour of molten aluminum would be poured into sow molds to solidify for storage/sales. A baghouse with lime injection would control the emissions from the furnace; dust cake collected from the baghouse would be sent to landfill. The proposed 25-ton capacity furnace and associated baghouse would replace Grooms' existing 6.25-ton capacity rotary furnace and associated baghouse.

The Saturn shear shredder will be used to reduce the size of incoming scrap; particulate matter emissions from the shredder are controlled by wet suppression. Crushing and screening operations, consisting of two crushers and a triple-decker screen, will be used to both reduce the size of incoming aluminum scrap and recover aluminum from the furnace's dross or salt cake to feed back into the furnace. Dross/salt cake and aluminum scrap will enter the jaw crusher for initial size reduction and be screened to aluminum fines, which would be fed back into the rotary furnace, and dross fines, which would go to landfill. Oversized pieces from the triple-decker screen would be processed again by an impact crusher and recycled back to the screen. Particulate matter emissions from both crushers and the screen would be controlled by a second baghouse. The crushers would be driven by electric motors rather than large engines.

EMISSIONS

Calculations are made on an 8,760 hour/year basis. Where needed, calculations are based on 6.83 TPH scrap and 0.56 TPH solid flux to the rotary furnace and an output 6.25 TPH molten aluminum and 1.14 TPH salt cake. The equipment comprising the crushing & screening section could operate at 100 TPH maximum, but a 8.65 TPH basis (1.1×6.83 TPH scrap plus 1.14 TPH salt cake) is used to account for the bottleneck created by the furnace. Similarly, the shredder could operate at 100 TPH maximum, but a 7.51 TPH basis (1.1×6.83 TPH) of scrap is used instead

Fugitive particulate matter emissions from salt cake removal from the rotary furnace have been approximated using the factor for particulate matter from low-silt slag batch-dropped from a front end loader, per AP-42 Table

12.5-4. NO_X, SO_2, and VOC fugitive emissions from the pouring & casting of aluminum have been estimated from the factors for SCC 30400114 from EPA's FIRE database.

Products of combustion for the furnace are based on EPA's AP-42 Ch. 1-4 factors for natural gas combustion. The rotary furnace has a 20 MMBtu/hr burner. Particulate matter from combustion of natural gas would be intermixed with the particulate matter generated by melting scrap.

Per Grooms' application, uncontrolled potential emissions of particulate matter are significantly higher than the limits imposed by ADEM Admin. Code r. 335-3-4-.04 for both the furnace and the crushing & screening operations. The rule limits PM from the furnace baghouse to 12.4 lb/hr, PM from the shredder to 12.53 lb/hr, and PM from crusher baghouse to 13.68 lb/hr at the maximum mass inputs used as the bases of calculation. To keep potential to emit (PTE) <100 TPY, Grooms has proposed 6.00 lb/hr and 4.28 lb/hr SMOP limits on total PM from furnace and crushing & screening operations respectively; wet suppression on the shredder's emissions should limit particulate matter sufficiently without the need for an explicit lb/hr limit. There would be no limit on PM_{10} and $PM_{2.5}$ specifically, but Grooms assumes that for the furnace, PM_{10} emissions would be 90% and $PM_{2.5}$ emissions would be 60% of the controlled total PM emissions; for the crushing and screening operations, Grooms assumes PM_{10} emissions would be 60% and $PM_{2.5}$ emissions would be 20% of the controlled total PM emissions. Grooms assumes only 0.0403 lbs PM per ton of shredded scrap would be emitted after applying wet suppression.

For the furnace, dioxin & furan (D/F) PTE is based on the limit stipulated by NESHAP RRR. Grooms estimates uncontrolled HAP emissions at 3.87 lbs HCl and 0.8 lbs Cl_2 per ton of charge/feed, which are factors derived from tests at similar facilities. Given the above emission factors and the maximum feedrate to the furnace in the application, the estimated uncontrolled HCl and Cl_2 emissions from the furnace are above 10 TPY of each pollutant. HCl and Cl_2 PTE for the furnace accounts for a 9.5 TPY SMOP limit on each of the two HAPs applied to furnace, expressed as 2.17 lb/hr for each HAP.

Table 1: PTE (TPY)

						Crushing & Screening*			
		Pouring & Casting (Fugitive)	Material Handling (Fugitive)	Rotary Furnace	Shear Shredder	Jaw Crusher	Impact Crusher	Screener	Totals
Criteria Pollutants	PM_{Total}	-	0.04	30.66	1.21	18.75			50.66
	PM_{10}	-	0.02	23.65	1.21	11.25			36.13
	$PM_{2.5}$	-	0.01	15.77	1.21	3.75			20.74
	NOX	0.01	-	8.59	-	-	-	-	8.60
	CO	-	-	7.21	-	-	-	-	7.21
	SO_2	0.02	-	0.05	-	-	-	-	0.07
	VOC	0.14	-	0.47	-	-	-	-	0.61
HAPs	HCl	-	-	9.50	-	-	-	-	9.50
	Cl_2	-	-	9.50	-	-	-	-	9.50
	D/F	-	-	8.975E-07	-	-	-	-	8.97E-07
	Other	-	-	0.16	-	-	-	-	0.16
	Total	-	-	19.16	-	-	-	-	19.16
	CO_2e	-	-	10,257.69	-	-	-	-	10257.69

*limit or related calculation applicable to common emission point

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LIMITS

Grooms has proposed Synthetic Minor Operating Permit (SMOP) limits to keep PTE below major source thresholds for PM, HCl, and Cl_2. Emissions from furnace will be limited to 6.0 lb/hr PM, 2.17 lb/hr HCl, and 2.17 lb/hr Cl_2; additionally, Grooms will limit its 3-day, 24-rolling average feed/charge rate to the rate they were operating during the most recent performance test. Emissions from the crushing and screening operations will be limited to 4.28 lb/hr PM. The SMOP limits for particulate matter are more stringent than those prescribed by rule 335-3-4-.04(1) when operated at max throughput, but the limit will be included in the permit as a formula to account for periods where Grooms is operating at a lower throughput.

Being a synthetic minor source of HAP emissions including HCl and Cl_2 will make Grooms an area source with respect to NESHAP RRR. The rule limits D/F emissions from furnaces at area sources of HAP emissions to 2.1×10^{-4} gr/ton$_{charge/feed}$. Further, Grooms must operate the furnace baghouse with a bag leak detection system, inlet temperature at or below the established level, lime injection feedrate at or above the established level, and total reactive chlorine flux injection rate at or below the established level.

REGULATIONS

STATE REGULATIONS

ADEM Admin. Code r. 335-3-4-.01 "Visible Emission"

Rule 335-3-4-.01(1)(a) states that no person shall emit to the atmosphere from any source of emissions, particulate matter of an opacity greater than twenty percent (20%) over a six (6) minute period. **Rule 335-3-4-.01(1)(b)** states that during one six minute period in any sixty minute period a person may discharge into the atmosphere from any source of emissions, particulate of an opacity not greater than that designated as forty percent (40%) opacity. Both baghouses will be subject to this regulation. The shredder is located inside the meltshop, so it cannot discharge directly to the atmosphere. However, the meltshop's roof vent and other openings are emission points that may not discharge visible emissions above the stipulated opacity. If well operated, baghouses have negligible opacity. If the hoods for the furnace efficiently capture and route emissions to the furnace baghouse, the meltshop itself should not have visible missions. However, if visible emissions are observed, the opacity should be determined using Method 9 of 40 CFR Part 60 Appendix A and corrected.

ADEM Admin. Code r. 335-3-4-.04, "Process Industries - General"

Rule 335-3-4-.04(1) states that no person in a Class 1 County (including St. Clair County) shall emit particulate matter greater than the amount determined by the equations below:

When $P<30$, $E=3.59P^{0.62}$
Where P = Process weight in tons per hour
And E = Emissions in pounds per hour

The hourly particulate matter limit is dependent on the process weight over a given hour, and the limit will be given in the permit as a formula. However, Grooms' application indicates at maximum 7.39 TPH of material to the furnace; therefore the maximum particulate emission limit on the furnace would be 12.40 lbs/hr. However, this is superseded by the chosen, more stringent SMOP limit of 6.00 lb/hr. Similarly, 8.65 TPH of material to the crushing & screening operations yields a PM limit of 13.68 lb/hr on its baghouse superseded by the chosen SMOP limit of 4.28 lb/hr.

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ADEM Admin. Code r. 335-3-14-.04, *"Prevention of Significant Deterioration (PSD) Permitting"*

Secondary metal production facilities are listed as one of 28 source categories listed in in ADEM Admin. Code r. 335-3-14-.04(2)(a)1 as having a 100 TPY major source threshold for criteria pollutants. Based on the emissions found in Table 1, the facility would not be expected to exceed the 100 TPY threshold. A facility must address PSD regulations for Greenhouse Gases (CO_2, N_2O, and CH_4) only if that facility is major for criteria pollutants. Per Rule 335-3-14-.04(2)(a)1(i)&(ii), no PSD review would be necessary for this project.

ADEM Admin. Code r. 335-3-14-.06, "Determinations for Major Sources in Accordance with Clean Air Act Section 112(g)"

This regulation applies to major sources of hazardous air pollutants (HAPs) constructed after March 27, 1998. Since this facility is not a major source of HAPs, a 112(g) case by case MACT review would not be necessary.

ADEM Admin. Code r. 335-3-15, "Synthetic Minor Operating Permits (SMOPs)" and 335-3-16, "Major Source Operating Permits (MSOPs)"

After considering the 6.00 lb/hr and 4.28 lb/hr PM limits on furnace and crushing & screening operations, respectively, as well as the PTE of the shredder after considering controls, the facility does not have the potential to emit greater than 100 TPY of any single criteria pollutant. The 2.17 lb/hr limits Grooms has proposed on HCl and Cl_2 emissions from the furnace would restrict the facility to less than 10 TPY of any single HAP, after which the facility would also not be expected to emit greater than 25 TPY of all HAP species. Additionally, Grooms has proposed to limit the feed/charge rate to the furnace to the average rate recording during the most recent performance test, as evaluated by a 3-day, 24-hour rolling average, to ensure conservative testing conditions when determining compliance with the above limits. Given the above, the facility will be considered a synthetic minor source for both criteria pollutants and HAP.

To match the testing schedule required by Subpart RRR, Grooms will conduct an initial compliance test on the above SMOP limits within 180 days of beginning operation. Subsequent performance tests will be conducted every 5 years.

Class I Area

The nearest Class I Area to the plant, the Sipsey Wilderness Area, is greater than 100 kilometers away, and the emissions from the proposed facility are not expected to have a significant impact on the Class I area.

FEDERAL REGULATIONS

40 CFR 60 "New Source Performance Standards"

No subparts within this part are applicable to the proposed facility.

40 CFR 63 Subpart A, "General Provisions"

This subpart is applicable provided that the facility is subject to one of the applicable subparts found under 40 CFR 63 "National Emission Standards for Hazardous Air Pollutants for Source Categories".

40 CFR 63 Subpart RRR, "National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production"

This subpart is applicable to each secondary aluminum processing unit (SAPU) and their constituent group 1 furnaces at both area and major sources of HAP. Only one furnace is present at Grooms' facility, so it is

referenced in this analysis rather than the SAPU. Due to the SMOP limits on HCl and Cl_2 emissions, the facility will continue to be considered an area source under this subpart, and the new furnace will be subject to the subpart's D/F emission standards and associated operating, monitoring, reporting, and recordkeeping requirements [§63.1500(c)(4)]. Dross mills are not regulated by this subpart. Scrap shredders are subject to this subpart, but only at major sources of HAPs.

Emission & Operational Standards

Dioxin & furan emissions, as D/F TEQ, from group 1 furnaces including the proposed new rotary furnace may not exceed 2.1×10^{-4} $gr/ton_{charge/feed}$ [§63.1505(i)(3)]. An overall emission limit given as a three-day rolling average applies to the SAPU per the formula found in §63.1505(k)(3); however, because there is just one furnace comprising the SAPU, Grooms has elected to comply with the furnace's individual limit rather than the three-day rolling average for the SAPU [§63.1505(k)(5)].

Additionally, the furnace must be labeled [§63.1506(b)], the associated fume hood and ductwork must be installed and operated correctly [§63.1506(c)], the daily charge/feed weight must be recorded [§63.1506(d)], the daily chlorine flux weight must be recorded, and the *total reactive chlorine flux injection rate*, which is a mass ratio of chlorine in the flux to the charge/feed, must be maintained at or below the average rate established during the last performance test [§63.1506(m)(5)].

For the furnace baghouse, Grooms must correct bag leak alarms [§63.1506(m)(1)], maintain the 3-hour block average inlet temperature below the average temperature (plus 25 ºF) established during the last performance test [§63.1506(m)(3)], and maintain free-flowing lime injection at the rate established by the last performance test [§63.1506(m)(4)].

Monitoring Requirements

For each furnace within the SAPU, Grooms must prepare and implement an OM&M plan [§63.1510(b)&(s)], inspect required labels [§63.1510(c)], maintain and inspect the required fume hood and ductwork including conducting annual flow measurements [§63.1510(d)], maintain calibrated scales to determine charge/feed weight [§63.1510(e)], maintain calibrated scales to determine flux weight [§63.1510(j)(1)], and calculate and record the *total reactive chlorine flux injection rate* [§63.1510(j)(2-4)].

For the furnace baghouse, Grooms must maintain and continuously operate a bag leak detection system [§63.1510(f)], must continuously monitor and record inlet temperature [§63.1510(h)], and must inspect the lime injection system to verify free-flowing lime [§63.1510(i)].

Grooms will conduct an initial D/F performance test on the furnace within 180 days of beginning operation [§63.1511(b)]. Method 23 in Part 60 Appendix A must be used [§63.1511(c)]. Operational standards including lime injection feed rate, baghouse inlet temperature, and total reactive chlorine flux injection rates shall be established [§63.1511(g), §63.1512(d),(k),(n-p)].

Recordkeeping & Reporting Requirements

In addition to recordkeeping required by Subpart A [§63.10(b)], Grooms must maintain records of the operating hours of each furnace, each baghouse leak detection system alarm plus corrective actions taken [§63.1517(b)(1)(i)], lime injection inspections and feeder settings [§63.1517(b)(4)], flux additions [§63.1517(b)(5)], charge/feed additions [§63.1517(b)(7)], label inspections [§63.1517(b)(13)], fume hood & ductwork annual inspections [§63.1517(b)(14)], the OM&M plan [§63.1517(b)(16)], and records of deviations and corrective actions taken [§63.1517(b)(18)].

Grooms must submit semiannual excess emissions/summary reports with 60 days of each reporting period meeting the requirements of §63.1516(b). Malfunctions must be reported per §63.1516(d).

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RECOMMENDATIONS

This analysis indicates that the proposed emission sources would meet the requirements of all federal and state rules and regulations if operated properly. Based on the expected emissions from Grooms' facility in Ashland, I recommend that Grooms be issued Synthetic Minor Operating Permit Nos. 410-0041-X002 & -X003, replacing the existing SMOP 410-0041-X001 and Air Permit 410-0041-X002.

May 13, 2021
Date

R. Jackson Rogers, Jr.
Industrial Minerals Section
Energy Branch
Air Division
ADEM

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Fugitives (material handling)				**Fugitives (Aluminum pouring)**			
9986.4	tpy dross & salt cake			54750	TPY metals charged		
0.0088	lb pmt/ton low silt	0.04394	TPY pmt	0.02	lb sox/ton metal	0.5475	tpy sox
0.0043	lb pm10/ton low silt	0.021471	TPY pm10	0.01	lb nox/ton metal	0.27375	tpy nox
0.0016	lb pm2.5/ton low silt	0.007989	TPY pm2.5	0.14	lb voc/ton metal	3.8325	tpy voc
Chapter 4 PM limits (superseded by SMOP limits)							
7.393	TPH material to furnace		8.65655	TPH material to crusl		7.51355	TPH material to shre
12.40976	=3.59P^.62 in lb/hr		13.68511	=3.59P^.62 in lb/hr		12.53483	=3.59P^.62 in lb/hr
54.35474	TPY		59.94078	TPY		54.90256	TPY

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Rotary Furnace products of combustion

Data:					AP-42 EF (NG)			Based on NG with Btu/Content of 1020				
H_2S mol%	0.00%	mol%			PM=	7.6	Lb/MMScf		GWP*			*Revised 11/29/2013
Op Hours	8760	Hrs			NO_X=	100	Lb/MMScf		N_2O=	298		
Heat Content	1,020	Btu/scf (Ind.)			CO=	84	Lb/MMScf		CO_2=	1		
Flowrate	**19.608**	MScf/Hr (Ind.)			VOC=	5.5	Lb/MMScf		CH_4=	25		
Heat Input	20,000,000	Btu/hr			HAP=	1.89	Lb/MMScf					
					SO_2=	0.60	Lb/MMScf					
Use btu/scf(EPA) for PM, NOx, CO, VOC. Factors for EPA STP (also ADEM STP). SO2 factor already for Industry STP (from Al. Oil & Gas Board)					(Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for C_3			(Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for C_1				
Ind. STP:	68	°F	14.696	psia	N_20=	0.0006	kg/MMBtu	N_20=	0.0001	kg/MMBtu		
EPA STP:	68	°F	14.696	psia	CO_2=	61.46	kg/MMBtu	CO_2=	53.06	kg/MMBtu		
Heat Content	1,020	Btu/scf (EPA)			CH_4=	0.003	kg/MMBtu	CH_4=	0.001	kg/MMBtu		
Fuel HHV Correction Factor	**1.000**											

Heater Emission Calculations

Pollutants														
PM	7.6	Lb	20.000	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	1.000	=	**0.653**	**Tons**
	MMScf (EPA)		Hr		1,020	Btu	Year	2,000 Lb			**Year**	
SO_2	0.60	Lb	20.000	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	1.000	=	**0.052**	**Tons**
	MMScf (EPA)		Hr		1,020	Btu	Year	2,000 Lb			**Year**	
NO_X	100	Lb	20.000	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	1.000	=	**8.588**	**Tons**
	MMScf (EPA)		Hr		1,020	Btu	Year	2,000 Lb			**Year**	
CO	84	Lb	20.000	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	1.000	=	**7.214**	**Tons**
	MMScf (EPA)		Hr		1,020	Btu	Year	2,000 Lb			**Year**	
VOC	5.5	Lb	20.000	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	1.000	=	**0.472**	**Tons**
	MMScf (EPA)		Hr		1,020	Btu	Year	2,000 Lb			**Year**	
HAP	1.89	Lb	20.000	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	1.000	=	**0.162**	**Tons**
	MMScf (EPA)		Hr		1,020	Btu	Year	2,000 Lb			**Year**	
CO_2	20	MMBtu	53.06	kg	0.001	Metric Ton	8,760	Hr	1.1023	Tons	=	**10,247**	**Tons**
	Hr		MMBtu		kg		Year		1 Metric Ton			**Year**	
N_2O	20	MMBtu	0.0001	kg	0.001	Metric Ton	8,760	Hr	1.1023	Tons	=	**0.01931**	**Tons**
	Hr		MMBtu		kg		Year		1 Metric Ton			**Year**	
CH_4	20	MMBtu	0.001	kg	0.001	Metric Ton	8,760	Hr	1.1023	Tons	=	**0.19312**	**Tons**
	Hr		MMBtu		kg		Year		1 Metric Ton			**Year**	
Mass Sum	10,247.10	Tons		+	0.0193	Tons	+		0.1931	Tons	=	**10,247**	**Tons**
	Year				Year				Year			**Year**	
	CO_2				**N_2O**				**CH_4**				
CO_2e	10,247.10	TPY	X 1		0.0193	TPY	X 298		0.1931	TPY	X 25	=	**10,258**	**Tons**
	10,247.10			+	5.76			+	4.83				**Year**	
	CO_2				**N_2O**				**CH_4**					

[1] AP-42 emission factors taken from Chapter 1.4. Based on natural gas with 1020 btu/scf, and corrected in calculations. From Chapter 1.5, propane emission factors are equivalent on a heat basis to methane factors, except the NO_X factor is 1.5x higher.

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